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THE FERN GAZETTE

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THIS ISSUE COMMEMORATES THE 80th BIRTHDAY OF A. C. JERMY

Clive Jermy raring to go at Cwmsymlog, Wales, equipped with waders and *Isoetes* sampling rake, July 2009. Photo: Martin Rickard.

CLIVE JERMY – A TRIBUTE ON THE OCCASION OF HIS 80th BIRTHDAY, 3rd JULY 2012

When I first joined the BPS the two main players were Jimmy Dyce and... Clive Jermy. Jimmy took care of the horticultural side of things as well as field recording and Clive was the scientist and the motor behind the Society's development into the more technical world.

Clive joined the Society in 1959 following his appointment as the bright young thing to replace A.H.G. Alston as head of the Fern section at the Natural History Museum in London. The Society was in reasonable heart at the time but several senior members had passed on and it needed an invigorating boost. Clive provided that change by immediately taking over editorship of the *British Fern Gazette.* In the process he changed it out of all recognition. Vague narrative accounts soon disappeared to be replaced by scientific technical articles. This change raised the profile of the journal in the world of international pteridology. As a result we had a strong surge in our membership. There was of course a down side. Initially several members complained about the shift in emphasis, with at least one senior member resigning in disgust. Jimmy Dyce came to the rescue, correcting any imbalance by launching the *Newsletter,* prompting the senior member to rejoin. The *Newsletter* was later replaced by the *Bulletin* and *Pteridologist* we see today.

As the *British Fern Gazette* grew under Clive's editorship so the Society flourished – the differing interests running through the membership could only add to the Society's strength. Through Clive's ever-expanding list of contacts worldwide our Society was able to successfully organise several international symposia. Big names from all over the world were happy to come if Clive invited them.

All the time Clive was developing the *British Fern Gazette* he was also building his department at the Museum. Assisted by Jim Crabbe he collected a small elite staff of budding pteridologists, including the obligatory pretty girl, or two! He must have been busy, yet when young keen members like me pestered him with queries they always received a prompt reply. The replies were little more than notes on scraps of paper but

Clive Jermy next to a fine specimen of *Osmunda regalis*, Cors Fochno, July 2009

he always supplied the information required. He always signed off – "In haste, Clive". He was obviously busy! Clive was great at getting everyone involved. In modern terminology he would probably be a 'facilitator'. On one occasion he asked me to check a record in Cornwall. He'd been sent a frond in the post with the added note – is this *Trichomanes*? I'm pretty sure the sender knew perfectly well it was, but Clive suggested it would be useful if I confirmed the record. This I duly did in December 1968. I was happy and so was Clive!

Typically generous, two or three years later Clive invited my wife and me to stay with him and his wife Alma at Otford. It enabled us to join in an Ashdown Forest meeting of the Society. A couple of years later we were able to return the gesture by having Clive and Alma, with their young children, Stuart and Nerida, and Jimmy Dyce join us for ten days in the French Alps, where I was working for the summer. To have Jimmy and Clive in such an environment was terrific. All that knowledge, keenness to explore... and dare I say... fun to be with!

Very sadly Alma died far too young, but before anyone knew it Clive had married again. His new wife, Valerie, was a very long standing friend of Clive and Alma. Valerie lived in Herefordshire not far from me. Can you imagine my surprise to one day literally bump into Clive in a street in Leominster, Herefordshire? I had no idea he was in the area. Leominster is a long way from Otford in Kent! I had never lived near Clive so it was almost too good to be true to have him as a near neighbour. Meetings were no longer confined to weeks or weekends away. We had meals at each other's houses and sampled the meals at a whole range of local pubs. There was a rule however, Valerie allowed talk about ferns until the meal arrived – after that the subject was banned – not always terribly successfully!

Quite recently Clive organised a *Dryopteris affinis* day in his village hall at Staunton-on-Arrow. Ken Trewren was the key speaker. Clive's connections with the Botanical Society of the British Isles (BSBI) came into play here. Several local vice-county recorders attended, adding significantly to the value of the meeting.

Clive Jermy (left) and Arthur Chater *Isoetes* hunting, Cwmsymlog, July 2009

Throughout the years I have known him, Clive has always had strong connections with the BSBI, why he was never elected their President is a constant source of amazement to me. Outside the world of ferns he was principal author of *British sedges* as a BSBI Handbook (1968); this was followed in 1982 and 2007 by considerably enlarged and updated editions. There were times when I wondered just how Clive could allow himself to be distracted by, to me, such an uninteresting group of plants!

Clive was of course one of the more prestigious Presidents of the BPS. During his tenure of the presidency the thorny issue of the Society name surfaced. This was one of the very few times I disagreed with him. He wanted change. I'm personally happy to say a ballot of all members was held with a large majority voting to keep the status quo. We did not fall out over it.

In July 2009 I was able to drive Clive over to stay with his friend, Arthur Chater, in Aberystwyth so he could join us on a weekend meeting centred on Machynlleth organised by Barry Thomas. Clive was up to his old tricks here! He strolled off into the icy waters of a mountain lake looking for *Isoetes*, admittedly wearing waders. Age was obviously having an effect – many years before I'd witnessed him venturing barefoot into a mountain lake in central France on the same quest!

Over the years Clive published very widely on ferns and lycophytes. It would be inappropriate for me to attempt a full bibliography, but notable publications include:
The phylogeny and classification of the ferns, with Jim Crabbe and Barry Thomas. 1973.
Atlas of ferns of the British Isles, with H. Arnold, Lynne Farrell and Franklyn Perring. 1978.
The genus Selaginella in tropical South America, with A.H.G. Alston and Josephine Rankin. 1981.
Cytotaxonomic studies of the ferns of Trinidad, with Trevor Walker. 1985.
A world of ferns, with Josephine Camus and Barry Thomas. 1991.
The illustrated field guide to ferns and allied plants of the British Isles, with Josephine Camus. 1991. (Reprinted and expanded in German in 1998.)

Very, very sadly Clive suffered a stroke late in 2009, leaving him semi-paralysed down the left hand side of his body, with his speech seriously impaired. Initially he was cared for in a hospital near Brecon, South Wales. At this time during a joint visit with Patrick Acock, Patrick and I started discussing equisetums. Clive was awake but not obviously interested in our conversation. I asked Patrick what the base chromosome number was for the genus. Patrick dithered, and before he could give an answer Clive shot out "108"! He was, of course, correct. Appearances are misleading. Despite the awful damage caused by the stroke Clive was very much on the ball.

Before long Valerie had the Staunton-on-Arrow cottage adapted to accommodate an invalid and Clive was back home, albeit with a live-in carer. I cannot overstate my admiration for Valerie during this period. She paid attention to Clive's every need with kindness and patience. Like everyone else I was devastated when I learned that she had passed away in her sleep. Life can be cruel. Clive's stay in Herefordshire therefore came to an abrupt end. He was moved north, initially to a care home near Oswestry and finally just north of Wrexham where he is quite close to his son Stuart. His daughter, Nerida, lives and works in Australia but frequently comes over to visit. There will be quite a gathering of family and friends at Stuart's home on the 14th July to celebrate the 80th birthday (on 3rd July) of one of the world's great pteridologists.

Martin Rickard

IS *EQUISETUM RAMOSISSIMUM* (EQUISETACEAE: EQUISETOPHYTA) NATIVE TO THE BRITISH ISLES?

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Keywords: *Equisetum* × *meridionale*, *Equisetum* × *moorei*, herbarium, hybrid

ABSTRACT

A review of historic collections at BM has revealed a specimen of *Equisetum ramosissimum* collected by Buddle on Hounslow Heath in c.1705. This thermophilous ruderal species has generally been considered a recent introduction in the British Isles, first reported in 1949, its neophyte status having implications for its continuing protection under Schedule 8 of the Wildlife and Countryside Act and other conservation actions. The hybrid with *E. hyemale* (*E.* × *moorei*) has long been known from the Irish east coast, in the absence of *E. ramosissimum.* Recently its hybrid with *E. variegatum* (*E.* × *meridionale*) has been recorded from Anglesey. Its recognition prompted a review of specimens of *Equisetum* subgenus *Hippochaete* from the Cheshire/Lancashire coast which showed obvious similarities, most previously regarded as *E. variegatum* or *E.* × *trachyodon*. The majority show distinctive micro-morphological characters associated with *E. ramosissimum* and are considered to be *E.* × *meridionale,* or possibly an as yet un-described triploid backcross to *E. variegatum*. Subsequently another overlooked BM herbarium specimen of *E. ramosissimum* from the Liverpool area, collected in the 19th century, was detected. We present a summary of the known occurrences of the species and, in the light of these new discoveries, re-assess the species status as "Native or Alien".

INTRODUCTION

As part of the London Natural History Society's *London Flora Project,* that aims to update Rodney Burton's (1983) *Flora of the London Area,* Nick Bertrand, John Swindells and MS have been reviewing historic records based upon herbarium specimens in the Sloane Herbarium at the Natural History Museum. Most of this work has resulted in augmentation of data reported in previous county floras (Trimen & Dyer, 1869; Kent, 1975 & Burton, 1983) or the database of the current Middlesex vice-county recorder (MS). So far several interesting pieces of information have come to light, including the re-determination by FJR of a specimen in Herb. Buddle, in the Sloane Herbarium, which has led us to a re-consideration of the status of *Equisetum ramosissimum* Desf. in England. Further herbarium researches (and molecular studies, Tosh *et al.*, in prep.) have provided additional and complementary evidence which considerably strengthens claim for native status for the species.

Equisetum ramosissimum is the most abundant, and often the only horsetail present around the Mediterranean region. An extremely variable taxon, it extends as an

unquestionably native plant northwards to the Loire valley in France, the mid reaches of the Rhine in Germany and eastwards through the Czech Republic, Crimea and into Southern Russia.

Prior to the herbarium discoveries reported here, the known history of this plant in the United Kingdom was as follows: it was first reported from an artificially created river bank near Boston, Lincs. (v.c. 53) (Alston, 1949), the plant having been discovered here in some quantity in 1947, by H. K. Airy Shaw. It has persisted to the present day, although in much reduced extent, the greater part of the colony having been destroyed by the extension of a municipal tip. As the habitat had effectively been created in 1884 (Gibbons, 1975) it seemed reasonable to assume that the plant was an introduction, particularly as a plausible potential mechanism - rhizome fragments in dumped ship's ballast - was proposed.

The species was next reported in 1983, from Ellenborough Park in Weston-super-mare, Somerset (v.c. 6), when Ro Fitzgerald sent Clive Jermy material for confirmation. It became apparent, however, that the plant had long been known at the locality (since at least 1963), but had not been correctly identified (Fitzgerald & Jermy, 1987). The site (Figure1), just inland from the sea front, is situated on an old sand dune system, the grassland within the park being a remnant of dune grassland enclosed over a century ago. Interestingly, the site lies within a few hundred metres of another sandy but once damper area, now developed, that less than a century ago supported the only v.c.6 population of *Equisetum hyemale* L., growing here with a variable population of *E. variegatum* Schleich., Schleicher ex F. Weber & D. Mohr, now only known in the county in very small quantity on the dunes at Berrow (Crouch, pers. comm.).

Figure 1. *Equisetum ramosissimum* at Ellenborough Park, Weston-Super-Mare, v.c..6 June 2011 (FJR)

Equisetum ramosissimum was subsequently found on a brown-field site close to the River Usk in Newport, Gwent (v.c.35) (Evans, 2006), where it was growing close to *Scirpoides holoschoenus* (L.) Soják, another coastal Mediterranean species of questionable British status. Although covering an area of c. 100-150 m^2 when first found, recent searches at the site (which was scheduled to be redeveloped when the plant was originally discovered) have failed to find the plant (Acock, pers. comm.). Its status in this area is rather more difficult to assess.

HERBARIUM DISCOVERIES SHOW A LONGER BRITISH HISTORY

The Sloane herbarium at BM contains a specimen (*Herb. Sloane* 117: 11) (figure 2) annotated by Adam Buddle as '*Equisetum nudum ramosum*, Buddle, I gathered it on Hounslow heath'; the specimen is also annotated 'R.H. 130' (referencing John Ray's *Historia Plantarum*, 1686) by Sir Hans Sloane and '15'(referencing Buddle's unpublished *ethodus nova stirpium Britannicarum* (Sloane manuscript 2975a vol. 6) by Dr Matthew Maty, Librarian of the newly established British Museum). Suspicion by MS that the plant was not *E. palustre* was confirmed by FJR who recognised it to be *E. ramosissimum,* a determination accepted by Pat Acock, the B.S.B.I. referee.

It is probable that Buddle's Hounslow Heath plant was initially mistaken for *E. hyemale*, which is currently rejected from the Middlesex flora (Trimen & Dyer, 1869: 336; Kent, 2000: 106). The original basis for including *E. hyemale* in the Middlesex flora is based upon references in *Plantæ Cantabrigensis* (Martyn, 1763: 71) and *Flora Metropolitana* (Cooper, 1836: 113), the latter stating that Edward Forster recorded *E. hyemale* from Hounslow Heath as well as *Baldellia ranunculoides* (L.) Parl.. In the Botany Library of the Natural History Museum there is a copy of *The Botanist's Guide through England and Wales* (Turner & Dillwyn, 1805) annotated by Dawson Turner; on page 413 the record of *E. hyemale* attributed to Edward Forster has been amended to 'Buddle'. Subsequently, Trimen and Dyer (1869: 336) commented that these references were mistakes either for *E. fluviatile* (as '*limosum*') or *E. palustre*. On the same page Trimen and Dyer (1869: 336) stated that the first record for *Equisetum palustre* L. in Middlesex was from "*Buddle*, about 1705. An unbranched form, *E. nudum ramosum* (III), on a bog on Hounslow Heath, where nothing as yet but this has sprung up after the digging of peat; *Budd. MSS.* vi and *Budd. Herb.* cxvii, fol. ii. This we suppose is *E. læve pene nudum* of *Pet. Gr. Conc.* 238 (see also *Dill.* in *R. Syn.* iii. 131)". This statement by Trimen and Dyer was presumably later taken up by Kent (1975: 136), who stated that the first evidence of *E. palustre* in Middlesex was from "*Buddle*, c. 1705". There is no specific indication by Kent that he viewed the Buddle specimen (*Herb. Buddle* 17: 11) or the relevant Buddle document in the Sloane manuscript collection (Sloane 2975a vol. 6).

Hounslow Heath is currently largely inaccessible through its proximity to Heathrow airport and has been heavily modified or destroyed since Buddle's day; there is one remaining area that survives, although that too has gone through many changes. This area is a designated Local Nature Reserve and still supports some heathland plants including bell heather (*Erica cinerea* L.), dwarf gorse (*Ulex minor* Roth), petty whin (*Genista anglica* L.), dyer's greenweed (*Genista tinctoria* L. ssp. *tinctoria*), heath rush (*Juncus squarrosus* L.), heath-grass (*Danthonia decumbens* (L.) DC.) and mat-grass (*Nardus stricta* L.). Historically, the heath was much richer and contained a significant list of vice-county and national rarities, most of which are now gone. Additional significant taxa recorded from the site between 1600 and the present day include:

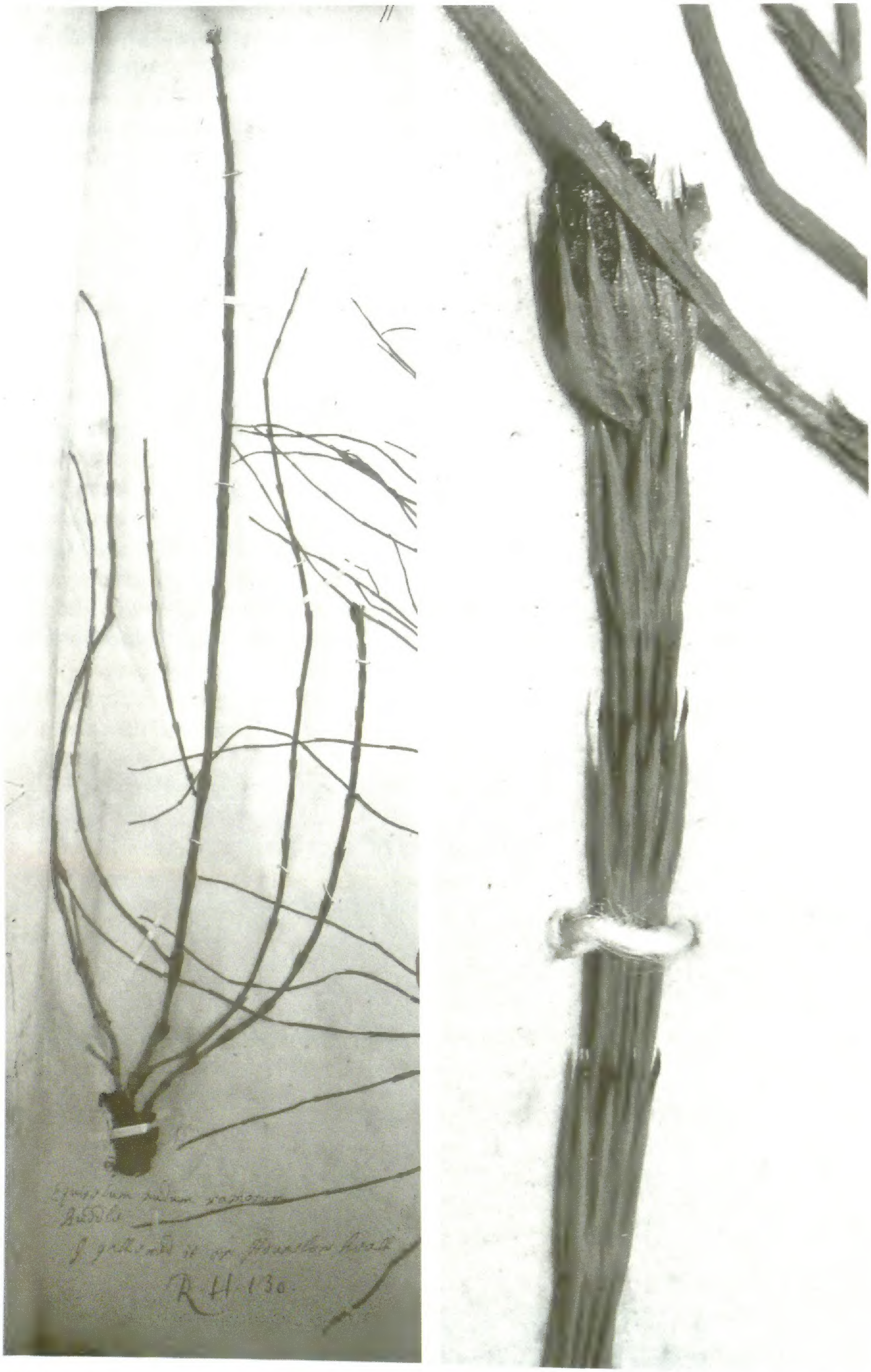

Figure 2. *Equisetum ramosissimum* specimen in *Herb. Sloane* 117: 11(BM) – right detail of apiculate strobilus.

Lycopodiella inundata (L.) Holub, *Lycopodium clavatum* L., *Blechnum spicant* (L.) Roth, *Pilularia globulifera* L., *Teesdalia nudicaulis* (L.) W.T. Aiton, *Viola canina* L. ssp. *canina*, *V. lactea* Sm., *V.* × *militaris* Savouré, *Hypericum humifusum* L. , *H. pulchrum* L., *H. elodes* L., *Cerastium semidecandrum* L., *Moenchia erecta* (L.) P. Gaertn., B. Mey & Scherb., *Sagina nodosa* (L.) Fenzl,. *Trifolium striatum* L., *T. subterraneum* L., *Potentilla anglica* Laichard, *Lythrum hyssopifolia* L., *L. portula* (L.) D.A. Webb, *Epilobium palustre* L., *Myriophyllum alterniflorum* DC., *Apium inundatum* (L.) Rchb. f., *Cicuta virosa* L., *Oenanthe fistulosa* L., *Calluna vulgaris* (L.) Hull, *Erica tetralix* L., *Centunculus minimus* L. , *Gentiana pneumonanthe* L., *Cuscuta epithymum* (L.) L., *Limosella aquatica* L., *Veronica scutellata* L., *Pedicularis palustris* L., *Euphrasia officinalis* L. ssp. *anglica* (Pugsley) Silverside, *Utricularia australis* R. Br., *U. minor* L., *Mentha pulegium* L., *Scutellaria minor* Huds., *Pulicaria vulgaris* Gaertn., *Filago minima* (Sm.) Pers., *Solidago virgaurea* L., *Chamaemelum nobile* (L.) All., *Cirsium dissectum* (L.) Hill, *Serratula tinctoria* L., *Baldellia ranunculoides* (L.) Parl., *Damasonium alisma* Mill., *Hydrocharis morsus-ranae* L., *Carex panicea* L., *C. echinata* Murray and *Koeleria macrantha* (Ledeb.) Schult. (Trimen & Dyer, 1869; Kent, 1975; Burton, 1983).

SUPPORTING EVIDENCE FROM HYBRIDS

Described from Rockfield, Co. Wicklow (v.c. H20) where it was first found in 1851 (Newman, 1854), *Equisetum* × *moorei* Newman, the hybrid of *E. ramosissimum* with *E. hyemale*, is present along a narrow, circa 50 km. long section of the eastern Irish coast, from Ardmore point in Co. Wicklow at the north, to Wexford Harbour, Co. Wexford in the south (Praeger, 1934). *Equisetum* × *moorei* was also known for many years in Surrey (v.c.17); first recorded (as *E. hyemale*) by Druce (1912), the plant steadily increased until the 1970s in the garden of Lady Victoria Russell at the Ridgeway, Shere (Lousley, 1976). It was initially closely associated with bamboos which had been introduced from one of the family's other gardens in the French Riviera and this was almost certainly its source. For reasons which are still unclear the plant declined and has not been seen for over 20 years in spite of several searches.

The extensive and clearly natural Irish distribution of *E.* × *moorei* has, however, been taken as the clearest indication of the past occurrence of *E. ramosissimum* as native in these islands, but other scenarios as to its origin are arguably as plausible and must be considered (see Discussion).

It is only extremely recently that further hybrids involving *E. ramosissimum* have been detected in the British Flora. *Equisetum* × *meridionale* (Milde) Chiov., the hybrid with *E. variegatum* was first found in coastal dune-slacks near Llyn Penryn, Anglesey, in 2000, but it was initially identified as *E.* × *trachyodon* A. Braun and not correctly determined until 2009 (Stace, 2010). A single diffuse thriving colony of several hundred stems is growing with one of its parents, *E. variegatum*. Living material from this site cultivated by FJR, while differing in propensity to cone, stature and branching, did not differ significantly in anatomy or micro-morphology from material previously ascribed to *E.* × *trachyodon* (*E. hyemale* × *E. variegatum*) from the Wirral coast, also in cultivation, as noted independently by Jepson et al., in prep. In particular the tubercles were not restricted to the angles of the stem ridges but formed continuous fused bands between the rows, a feature demonstrated by *E. ramosissimum* and also present in its hybrids (Lubienski *et al.* 2010). The hybrid horsetail on the Wirral coast has been contentious for many years; having been called both *E. variegatum* and *E. hyemale*, it

was then identified as the first English occurrence of *E.* × *trachyodon* by Chris Page in 1979 (Barker, 1979), but it was noted to differ from typical material in its greater degree of branching. When first reported the plant was recorded as occurring along a 1.3km section of coastline stretching south from Red Rocks, Hoylake (v.c..58). Material from the northern end of the colony, growing with *E. variegatum*, was said to more closely approach that in form, whereas that further south was more robust and was said to be more like *E. hyemale* (Barker, 1979). *Equisetum hyemale* had been recorded in the general area (Dickinson, 1851; Newton, 1971) but in the absence of herbarium specimens these records are doubtful. *Equisetum hyemale* did however occur at Heswell, 7km further south along the Dee estuary in 1871 (BM!) its current extent, ecology and morphology are discussed by Jepson et al., in prep. Examination of specimens of subgenus *Hippochaete* at BM from the Cheshire and adjacent Lancashire coasts revealed that the majority of specimens (26 sheets) previously determined as *E. variegatum*, while agreeing with it in most particulars, showed the tubercle character associated with *E. ramosissimum*. Interestingly these plants were not just from the Hoylake area but also from New Brighton and Wallasey in Cheshire and Southport and Crosby on the Lancashire coast (see Appendix 1 for specimen details). The earliest dated specimen was from New Brighton, collected by S. Simpson in 1839, although an undated gathering made by W. Borrer from the same site may be earlier.

The considerable morphological similarity with *E. variegatum* (which is still present at the majority of these sites) suggests the possibility that some of these plants might represent a triploid hybrid resulting from the mating of a diplospore (unreduced gamete) from *E.* × *meridionale* with a normal gamete from *E. variegatum*. Bennert *et al.*, (2005) have shown this mechanism has given rise to three hybrid combinations in the subgenus *Hippochaete* in central Europe, although this hybrid combination of genomes (VVR) has not hitherto been reported. Further work is needed to establish the ploidy level of these plants. What is obvious, however, is that by the mid 19th century plants containing *E. ramosissimum* genes were already spread along almost as extensive a length of the English coast as were their *E.* × *moorei* counterparts on the other side of the Irish Sea.

During the herbarium study a single specimen "nr. Liverpool, H. Seebohm Ex herb. J. Carroll (See figure 3) was identified as being *E. ramosissimum*. Henry Seebohm (1832-1895) was a wealthy industrialist and amateur natural historian particularly remembered for his oological studies. This find demonstrates the past occurrence of *E. ramosissimum* in the area and suggests that some earlier unsupported records of *E. hyemale* may well have been of this species.

DISCUSSION

Whilst as a thriving port Liverpool might be expected to harbour weedy introduced ruderal taxa like *E. ramosissimum*, which could perhaps explain the newly found Seebohm specimen, the extent of the distribution of *ramosissimum* genes along the Cheshire and Lancashire coasts by the mid 19th century suggest a much longer history in the area. That this species was present to act as parent also influences considerations as to how these hybrid plants have originated.

The Irish and Welsh hybrids may have formed *de novo* possibly from the fertilisation of *E. ramosissimum* gametophytes developed from spores dispersed from continental Europe, these becoming "swamped" by antherozoids from more numerous native *E. hyemale* or *E. variegatum* gametophytes, rather than having been derived from

Figure 3. *Equisetum ramosissimum* specimen from "Near Liverpool" H. Seebohm. **BM** – far left on mixed sheet.

native *E. ramosissimum* populations now lost. Both *Equisetum* hybrids (*E.* × *moorei*, *E.*× *meridionale*) demonstrate very low spore fertility. The great majority of spores in British and Irish plants are abortive, with most having poorly developed elaters. The degree of fertility is, however, variable, and small number of gametophytes of both *E.* × *meridionale* and *E.* × *moorei* from Central Europe have been raised under experimental conditions (Krahulec *et al.*, 1996). Even so, colonisation by this means is highly unlikely. Colonisation by vegetative material cannot, however, be ruled out; experimental evidence suggests that shoot and root fragments of *E.* × *moorei* and other *Hippochaete* hybrids can survive at least 10 days immersion in sea water (Page, 1997). It does, however, seem unlikely and to have occurred at three localities even more so. Perhaps the greatest obstacles to the view that *E. ramosissimum* is native is in explaining its current absence in areas occupied by its hybrid and in the lack of history of its most apparently natural British occurrence. In answer to the former the greater cold-hardiness demonstrated by the hybrids could explain their ability to persist in a changed climate at the northernmost extents of range of their thermophilous parent (Page, 1997). Concerning the Somerset site, how plausible is it that the other *Equisetum* species were found locally very early in the 20th century but not the now abundant *E. ramosissimum*, or indeed, that very early observers such as Sole, who found other local rarities would have missed the plant? The evidence presented here suggests that in both its pure and hybrid forms this very variable and frankly rather nondescript plant is very easily over-looked!

The Somerset locality is worthy of further consideration. Ellenborough Park appears to be an area of some phytogeographical interest; alongside a suite of uncommon species such as *Trifolium suffocatum* L. and *Medicago polymorpha* L., it also supports populations of *Herniaria glabra* L. (first recorded by Sole in 1791 but for a long time dismissed as an error) at its only persistent western British location (Green *et al.*, 2000). On its seaward side occur thriving populations of another Mediterranean ruderal species of questionable status, *Cynodon dactylon* (L.) Pers. (Bermuda grass). With an, until now, longer British history, (being first recorded in Ray, 1724) this grass has found greater acceptance as a possible native (e.g. Walls, 1999, but see Preston *et al*, 2002). The close association of the horsetail on the north Somerset coast with a distinctive thermophilous arenicolous flora similar to that of natural occurrences on the French coast suggests that at worst it was a natural colonist, a fact recognised by its legal protection under Schedule 8 of the Wildlife and Countryside Act, 1981. Classification as a neophyte in Preston, *et al.* (2002) inevitably has had the consequence of reducing its perceived importance with implications for future conservation activities.

The specimen from Hounslow Heath is significantly earlier than any other British record (approximately 150 years before Seebolm's record and at least 250 years before the 20th century discoveries). It is worth noting that in its prime Hounslow Heath had a floristic diversity comparable with or exceeding the species-rich plant communities found on the plains of the New Forest today, many of which have a distinctly southern Mediterranean flavour. It is also worth noting that the Buddle Herbarium has also proved invaluable in helping in evaluate the status of *Cystopteris diaphana* (Bory) Blasdell in the UK (Murphy & Rumsey, 2005; Rumsey 2007).

While no one strand of this evidence conclusively supports a native status for *E. ramosissimum*, in combination they do form a more compelling case and together suggest that dismissing the species as a neophyte is unwise. While somewhat unsatisfactory we recommend the listing of *E. ramosissimum* as "Native or Alien" as

the best solution.

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APPENDIX 1.

Specimens of *E.* × *meridionale* (or triploid hybrid) at BM

v.c..58 Cheshire

New Brighton. W. Borrer (Herb. Ed. Forster -1849)
New Brighton, Cheshire, June 1839, ex. herb. S. Simpson
Sandhills, New Brighton, on the shores of the Mersey near Liverpool. 18 June 1842, J.B.W.
N. Brighton, Liverpool, Aug. 1842. Ex herb. J. Dickinson.
New Brighton, 10/1842 ex herb. Silvanus Thompson.
New Brighton, Cheshire, 1843 S. Thompson
Nr New Brighton, Cheshire 1843 ex herb. W.C. Barton
New Brighton, Cheshire, 30 July 1849, J. Sansom
New Brighton Cheshire, July 1850, ex herb. J. Dickinson
New Brighton, Cheshire, 1869, H.J. Fisher
Wallasey, sand hills, 9/[18]71, H. Fisher
Coast sandhills, Wallasey, Cheshire 30 V 1874, J. Harbord Lewis
Sandhills, Wallasey, Cheshire, 1 Oct. 1891, S.W. Woodhead
Wallasey sandhills, Sept. 1905, E.D [mixed sheet with E. palustre]
Wallasey sandhills, July 1909, E. & H. Drabble [Watson Bot. Exch. Club]

v.c..59 S. Lancashire

Crosby, Lancashire 25.VI. [18]70, J. Harbord Lewis
Southport, Lancashire, 1883, H. Searle
Sandhills, Southport, Lancashire, 6.[18]84, H. Searle

CRYPTOGRAMMA BITHYNICA SPEC. NOV. (PTERIDACEAE, PTERIDOPHYTA) – A NEW FERN SPECIES FROM NORTHWESTERN ANATOLIA / TURKEY

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Keywords: *Cryptogramma*, Pteridaceae, Pteridophyta, Anatolia, Turkey, cytology, flow-cytometry

ABSTRACT

An octoploid taxon of *Cryptogramma* from the Uludağ Mts. in northwestern Turkey is described as a new species, *Cryptogramma bithynica* S. Jess., L. Lehm. & Bujnoch. An overview of the genus is given.

ZUSAMMENFASSUNG

Ein octoploides Taxon von *Cryptogramma* vom Uludağ in der nordwestlichen Türkei wird als neue Art, *Cryptogramma bithynica* S. Jess., L. Lehm. & Bujnoch beschrieben. Ein Überblick über die Gattung wird vorangestellt.

INTRODUCTION

The taxonomy within the genus *Cryptogramma* has been in dispute for a long time. In most cases (Meusel et al. 1965, Dostál 1984, Kramer & Green 1990), the only distinction which has been made is that between the boreal Asian and North American *Cryptogramma stelleri* and the more widespread *C. crispa*, a species distributed in circumpolar regions and in southern Central and East Asia as well as in southern parts of South America. A subdivision of the latter into several taxa was made on the level of subspecies or varieties (Meusel et al. 1965, Dostál 1984). Cytological studies revealed that the different taxa are of different ploidy level: diploid, or tetraploid. The origin of polyploids is mostly unresolved. However, allopolyploidy seems to be important for speciation; apparently, the North American tetraploid *Cryptogramma sitchensis* has been derived by hybridization from *C. acrostichoides* and a second, now allopatric species, possibly *C. raddeana* of East Asia (Alverson 1993).

At present, eight to eleven species are distinguished (Alverson 1993). Most of them have been cytologically examined, are morphologically distinguishable and their ranges are known (Jeßen 2008):

- *C. acrostichoides* R. Br.: 2n = 60, diploid; central to north-western North America as well as outermost north-eastern East Asia
- *C. brunoniana* Wall. ex Hook. & Grev.: 2n = 60, diploid; southern Central Asia, eastwards as far as Taiwan.

• *C. cascadensis* E.R. Alverson: 2n = 60, diploid; western North America
• *C. crispa* (L.) R. Br. ex Hook.: 2n = 120, tetraploid; Europe as far north as northern Urals, Great Caucasus and Caucasus Minor, north-western and north-eastern Turkey as well as an unconfirmed area in northern Turkey (Meusel et al. 1965)
• *C. fumariifolia* (Phil. ex Baker) Christ: 2n = ?; south-western South America (Chile, Argentina)
• *C. raddeana* Fomin (*C. brunoniana* ssp. *raddeana* [Fomin] Fraser-Jenk.): 2n = 60?; south and south-eastern Siberia (region of Lake Baikal, Stanowoi Mountains, Primorje, region of Amur) and China (Hubei, Shaanxi, Sichuan, Xizang, Yunnan)
• *C. sitchensis* (Rupr.) Moore: 2n = 120, tetraploid; north-western North America
• *C. stelleri* (Gmel.) Prantl: 2n = 60, diploid; northern and eastern Asia, western and eastern North America; in Europe reaching only northern and eastern Urals as well as the Petschora valley and the Timan region

No comment is given to the taxonomic status of *C. emeiensis* Ching & K.H. Shing (Acta Phytotax. Sin. 20: 234, 1982) and *C. shensiensis* Ching (Fl. Tsinlingensis 2: 206–207, t. 15, f. 4–6, 1974). The combination *Cryptogramma anomophyllum* (Zenker) Fraser-Jenk. (Taxon. Revis. Indian Subcontinental Pteridophytes 330, 2008) is due to a confusion with *Cyrtomium anomophyllum* (Zenker) Fraser-Jenk. (C.R. Fraser-Jenkins in litt. 07-11-2011).

Cryptogramma crispa senso stricto is mostly restricted to Europe (Bennert 1999). The species reaches Western Asia only in the northern part of the Urals, the Caucasus and in Turkey. With 2n = 120 chromosomes it is tetraploid (Manton 1950). However it

Figure 1. *Cryptogramma bithynica* at its *locus typicus*: NW Turkey, Uludağ, 1770 m; photo: S. Jeßen 09-09-2009.

is unknown whether it is an auto- or allopolyploid. Of the putative diploid ancestors *C. stelleri* can clearly be excluded for morphological reasons. Therefore, diploids which may represent ancestors of the widespread *C. crispa* are missing, at least in Europe and neighbouring regions, a fact making the search for cryptic taxa within the range and for isolated populations outside the main range of great interest.

One such disjunct population, far from the main range, is situated in the Uludağ Mountains, at the so-called Bithynic Olympus in northwestern Turkey (Davis 1965). The plants growing there are morphologically different from *C. crispa* (Figure 1). This prompted cytological examinations which revealed (see below) that they represent a different ploidy level to *C. crispa* (4x), but do not represent a potential diploid progenitor. This degree of ploidy has not previously been recorded in the genus *Cryptogramma*. In the following, this taxon is accordingly described as a new species.

MATERIAL AND METHODS

A selected range of cultivated material of known wild origin and herbarium specimens representing the major *Cryptogramma* taxa were investigated. Their gross morphological characteristics were compared, spore sizes (an often reliable proxy for ploidy level) were measured and cytological investigations were performed on living material. The following comparative material was evaluated:

C. acrostichoides, SJ-2550; Canada: British Columbia, Pemberton; leg. C. Kohout 27-06-1992

C. acrostichoides, SJ-3498; USA: California, Sequoia NP near Mineral King; c. 2800 m; leg. P. Achnitz Sept. 2001

C. brunoniana, SJ-3779; N India: Sikkim, northern part: Yume, 3800 m; spores date from the Botanical Garden Brno 03 1; sown 22-09-2004 and cultured, pressed 10-06-2007

C. crispa, SJ-603; Bulgaria: Rila Mountains, Jakoruda, southern slope of Granchar, 2250 m; leg. S. Jeßen 23-07-1983

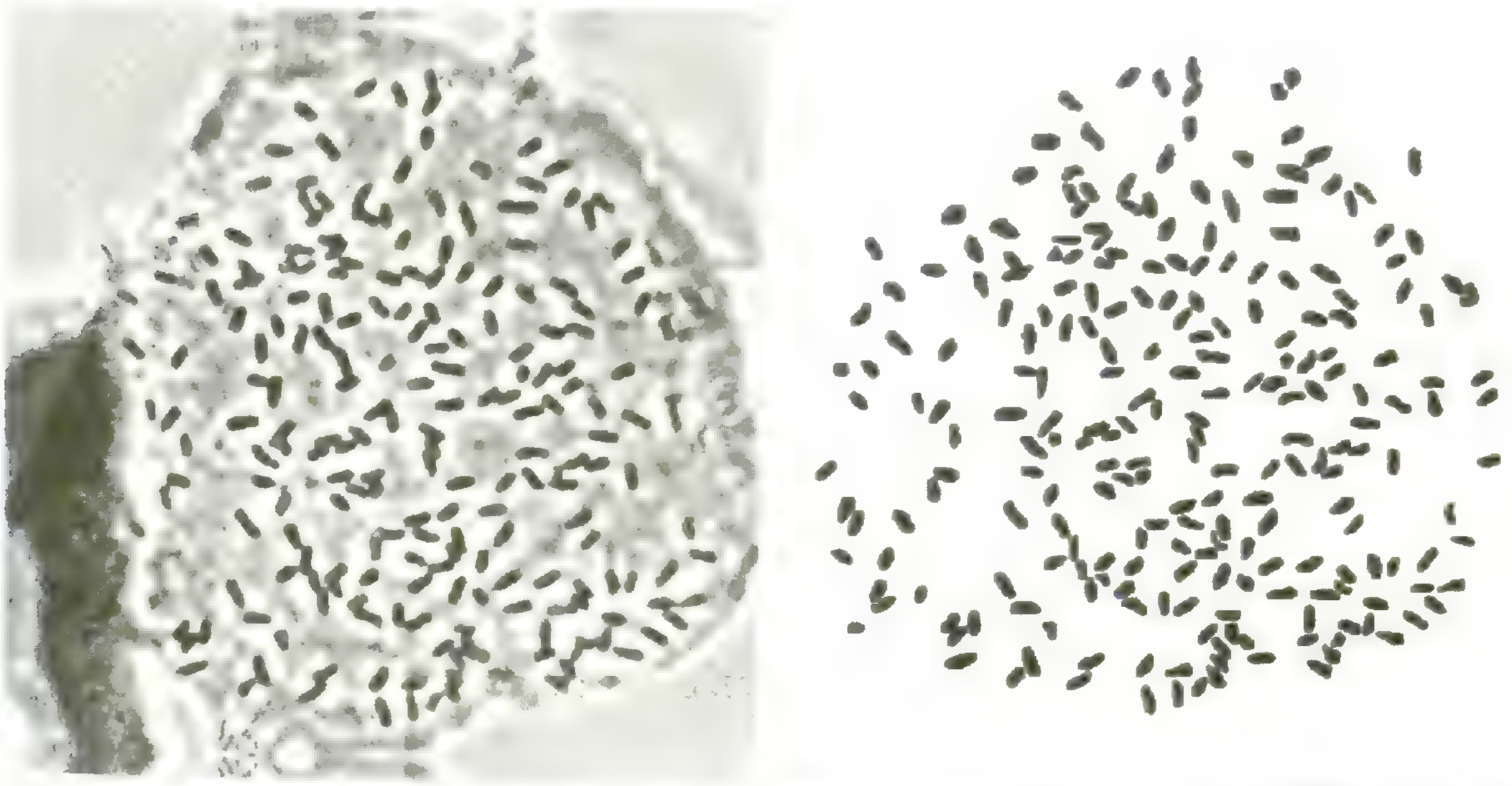

Figure 2. Mitosis in a root tip cell of *Cryptogramma bithynica*: SJ-3820, cult. in Chemnitz (left: photograph, right: explanatory diagram). Nearly 236 chromosomes are visible, some others are probably hidden in the dark part of the metaphase plate; preparation and photo: W. Bujnoch.

C. crispa, SJ-604; Bulgaria: Pirin Mountains, Vichren region, Mouratovo ezero, 2250 m; leg. S. Jeßen 21-06-1976
C. crispa, SJ-605; Bulgaria: E Pirin Mountains, Hleven Massif, Kornishki Circus, c. 2300 m; leg. S. Jeßen 03-07-1978
C. crispa, SJ-606; Poland: Karkonosze, silicate boulder field in Wielki Śnieżny Kocioł, 1300 m; leg. I. Schwerdtner & S. Jeßen 21-08-1977
C. crispa, SJ-2771; Italia: Tuscany Soarenaria, Apennino luccese-modenese-Dintorni dell´ Abetone (PT), M. Femminamorta, c. 1800 m; leg. D. Marchetti 29-08-1987
C. crispa, SJ-2920; France: Pyrenees, Cirque de Troumouse, 2150 m, silicate scree and rocks; leg. J. Hemmerling, S. Jeßen & L. Lehmann 18-08-1997
C. crispa, SJ-3099; Russia: northern Caucasus, Lakes of Baduk, Dombai-vally, c. 2000 m; leg. J. Hemmerling & W. Meusel 1965; cult., pressed May 2007
C. crispa, SJ-3819; Switzerland: Ticino, Brissago near Locarno, Piodina, climb from Cortaccio to Gridone, c. 1600 m; leg. S. Jeßen 10-07-2009
C. crispa; SJ-3874; Switzerland: Ticino, Val Serdena bei Isone, 1640 m; leg. S. Jeßen 10-07-2011
C. crispa; SJ-3865; NE Turkey: Prov. Artvin, southwestern precipice of Tyrial Dağ, bolder slope at 1600 m; 41°10'24,1"N, 41°35'33,4"E; leg. S. Jeßen & L. Lehmann 07-09-2011

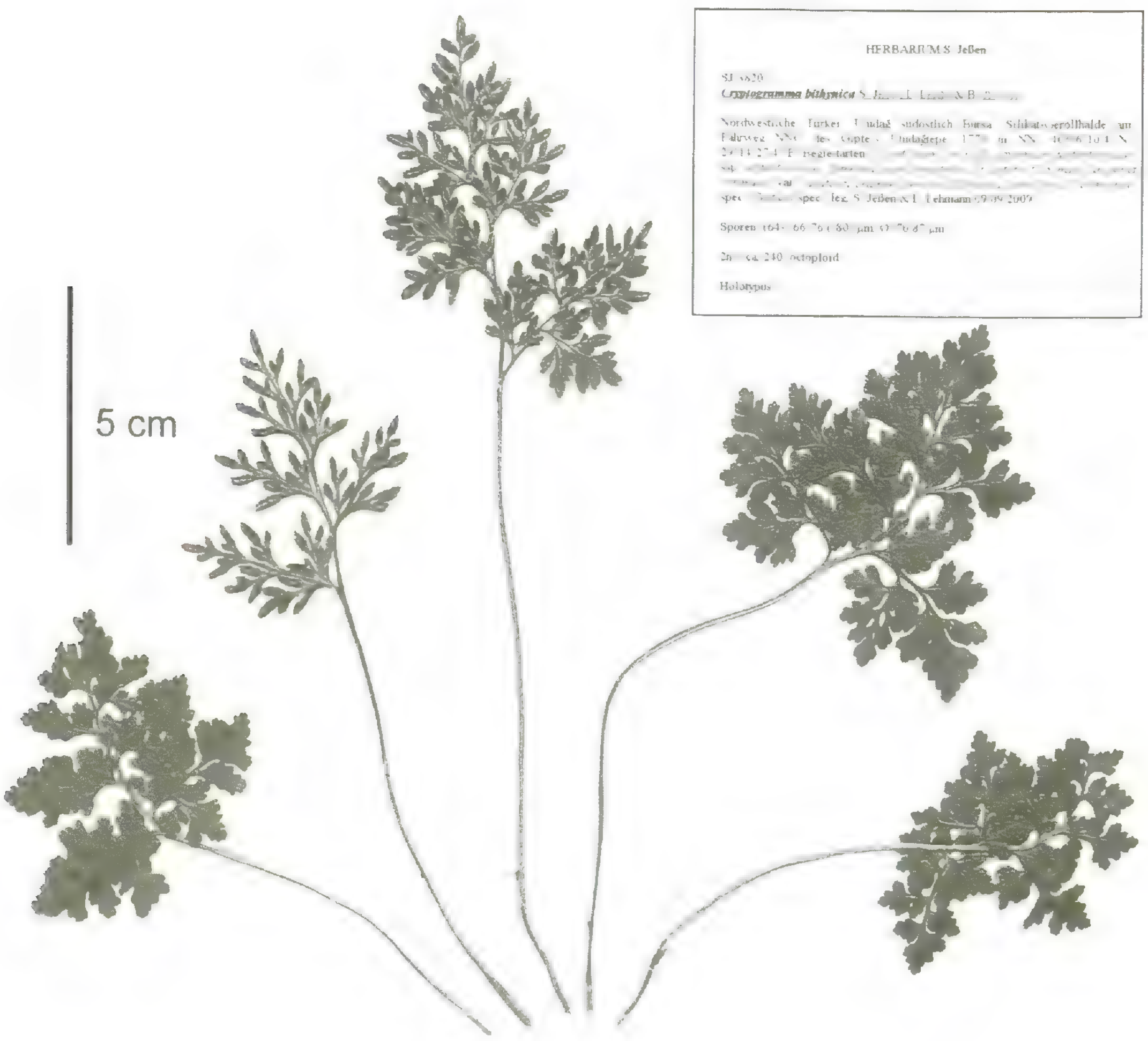

Figure 3. Holotypus of *Cryptogramma bithynica*.

C. fumariifolia; Argentina: Neuquén, Estancia Mamuil-Malal; Obs.: 1400 m; Meseta al S. de la Estancia entrapocas; Celec.: Diem 2074; Fecha: 20-3-1952; Herbarium Hamburgensis (HBG)

C. bithynica, SJ-3820; Türkei: Uludağ, silicate scree near the cycle roadway, NNO Uludağtepe, 1770 m; leg. S. Jeßen & L. Lehmann 09-09-2009

RESULTS

The determination of the spore length of different samples of *C. crispa* (SJ-3819, 3865, 3874) yielded values between (40–) 48–57 (–59) µm, those of the diploids *C. acrostichoides* (45) 52 58 (62) µm and *C. brunoniana* (50–) 51 60 (66) µm. Remarkably is the comparable value between the diploid species and the tetraploid *C. crispa*. The spores of the plants from Uludağ measuring (64–) 66–76 (–80) µm (mean = 70.87 µm) proved to be noticeably longer. For these reasons, a sample of the taxon in question was sent together with several comparative samples of *C. crispa* on 27-09-2009 to Prof. R. Viane, Gent, for flow-cytometrical analysis. Material of the above listed plants SJ-2550, 2920, 3099, 3779, 3819 and 3820 was analysed using a flow cytometer (Partec PA-1, Partec GmbH, Münster, Germany), following the manufacturer's protocol.. This revealed nearly twice the quantity of DNA for the material from Uludağ in comparison to *C. crispa* from various other regions of Europe (pers. commun. R. Viane 06-10-2009).

For cytological examinations, fixations were performed using root tips from young plants of Uludağ (SJ-3820), cultivated in the Arktisch-Alpiner-Garten, Chemnitz/Germany. The analysis was carried out applying the method of Manton

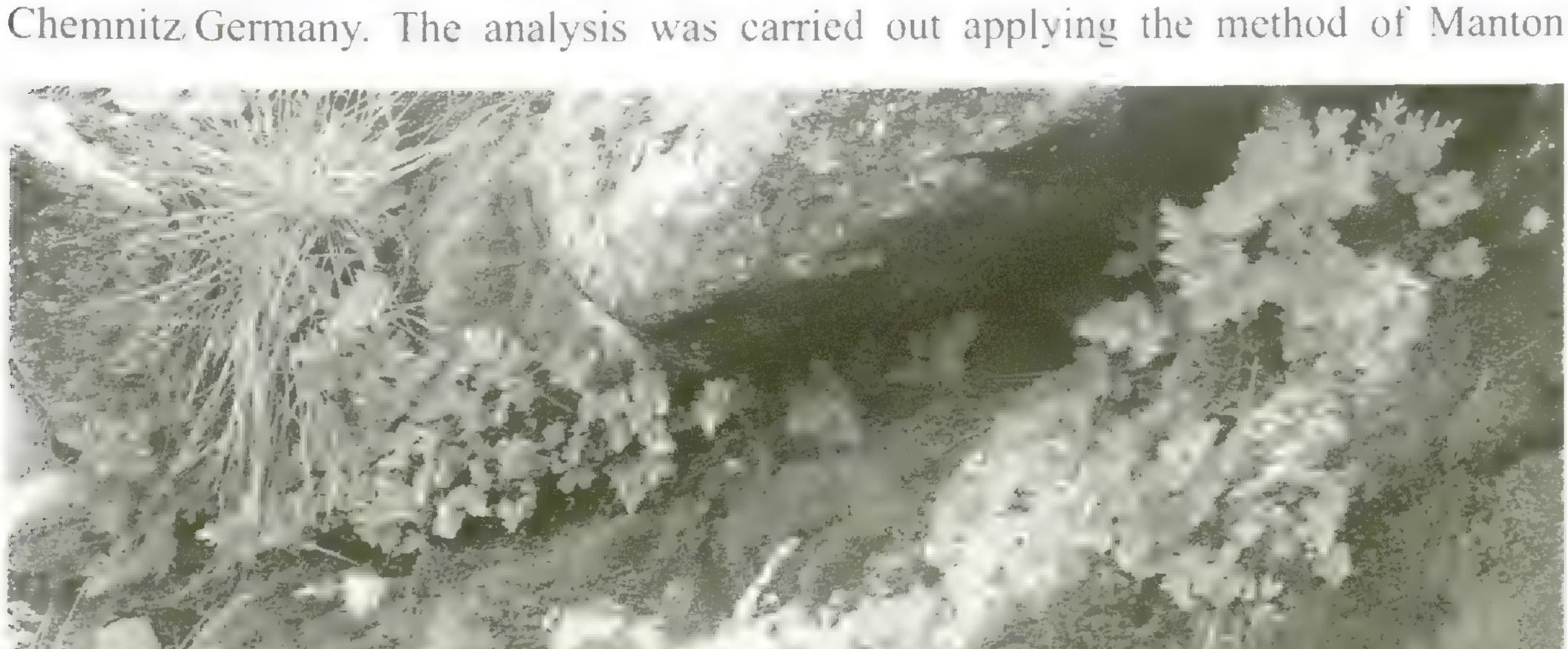

Figure 4. *Locus typicus* of *Cryptogramma bithynica*. NW Turkey, Uludağ, 1770 m. Photo: L. Lehmann 09-09-2009.

(1950). The count of a metaphase plate of a mitotic cell revealed approximately 240 chromosomes (Figure 2). The basic number of chromosomes for the genus *Cryptogramma* is x = 30. Consequently, the plant is octoploid. This represents the first record of octoploidy within the genus.

TYPIFICATION AND DESCRIPTION

Cryptogramma bithynica S. Jess., L. Lehm. & Bujnoch **spec. nov.,** Bithynic Parsley Fern

Locus: Northwestern Turkey: Uludağ southeastern of Bursa: silicate scree near the roadway, NNE of the summit of Uludağtepe, 1770 m; 40°06'10,4"N, 29°14'27,4"E.

Holotypus: 09-09-2009, leg. S. Jeßen & L. Lehmann (SJ-3820), JE. (Figure 3).

Isotypi: 09-09-2009, leg. S. Jeßen & L. Lehmann (SJ-3820), ANK, Herbarium S Jeßen.

Derivation: Derived from its appearance on the so-called Bithynic Olympus, Uludağ Mountains in northwestern Turkey.

Description

Rhizoma serpens ad surgens. Folia nuda, fasciculis ordinata. Folia sterilia crassiora, usque ad 17 cm longa; lamina plerumque lata et triangula, 3–7 cm longa, 3–7 cm lata, tripinnata. Petiolus folii maxime duplo longior lamina, minimum aeque longus; infra

Figure 5. Habitat with patches of *Cryptogramma bithynica*. Photo: L. Lehmann 09-09-2009.

paucae squamae fulvae, 2–8 mm longae. Pinnae foliorum sterilium latae et triangulae, quattuor ad sex paribus ordinatae, plerumque spissae et saepe alterae super alteras latius patentes. Segmenta ultimi ordinis ovata ad rotundiora, aut desinentia in dentes latos sed acutos aut suborbiculata. Folia fertilia usque ad 22 cm longa. Lamina lata et triangula ad ovata, tri- aut quadripinnata. Petiolus folii maxime duplo longior lamina, minime aeque longus. Segmenta ultimi ordinis linearia ad oblonga, 3–9 mm longa et 1–3 mm lata. Sporae (64–) 66–76 (–80) µm longae. Planta octoploidea, chromosomatum numerus 2n = c. 240.

Rhizome creeping to ascending, dividing into bushy branches; leaves glabrous, standing in tufts, sometimes caespitose; sterile fronds relatively thick, up to 15 (17) cm in length with mostly broad deltoid tripinnate lamina, 3–7 cm long and 3–7 cm in width; petiole 1–2 times longer than the lamina, at the base sparsely covered with light-brown scales of 2–8 mm length; pinnae of sterile leaves wide and deltoid, relatively stocky, stalked, sessile at the tip of the lamina, 4–6 pairs, in most cases arranged densely and often in large parts overlapping; ultimate segments ovate to orbiculate, ending in wide, pointed teeth or rounded; fertile fronds up to 17 (22) cm long with wide deltoid to orbicular, three- to fourfold pinnately divided lamina; petiole 1 2 times longer than the lamina; ultimate segments lanceolate to oblong, 3–9 mm in length and 1–3 mm in width; length of spores: (64) 66–76 (80) µm; maturing of spores: August to September; cytology: 2n = c. 240, octoploid.

Distribution, ecology and sociology

Only known from the high mountains of Uludağ, southeast of Bursa in north-western Turkey, where the species is to be expected to occur in other places. The fern colonises clefts with fine-grained soil in rocks and between boulders at sub-alpine altitudes above 1770m (Figures 4, 5). In addition to the *locus typicus* at 1770 m it was found on silicate rock on a north-east facing slope of scree and rocks between Lake Karagöl and Uludağtepe (at 2230 and 2280 m). Other plants growing in the same habitat are *Polystichum lonchitis* (L.) Roth, *Asplenium septentrionale* (L.) Hoffm. subsp. *septentrionale*, *Gymnocarpium dryopteris* (L.) Newman, *Dryopteris filix-mas* (L.) Schott, *Juniperus communis* L. var. *saxatilis* Pall., *Daphne oleoides* Schreb., *Sibbaldia parviflora* Willd., *Paronychia* sp., *Festuca* sp.

DIFFERENTIATION FROM *CRYPTOGRAMMA CRISPA*

Cryptogramma bithynica is closest in morphology and in distribution area on the Balkan Peninsula and in northeastern Anatolia to *C. crispa*, but can be distinguished by the characters outlined below (Table 1).

Cryptogramma brunoniana is another species which might be related to *C. bithynica*, and whose Asian range reaches as far west as Pakistan and Afghanistan. It reaches a height of only 15 cm and has relatively thick winter-green sterile leaves with a blade length of only 2 5 cm whose last order leaflets end in strong, pointed teeth. But at present, apart from the presumption that *C. bithynica* has arisen, by chromosome doubling from a tetrapoid ancestor there are no plausible insights into the parentage of the new species.

Table 1: Morphological comparison between *Cryptogramma crispa* and *C. bithynica*

Trait	***Cryptogramma crispa***	***Cryptogramma bithynica***
plant size	up to 30 (–45) cm	up to 17 (–22) cm
sterile leaves	summer-green, thin and fine	summer-green, slightly thick, relatively tough
lamina of sterile leaves	up to 9 cm wide and 16 cm long, ovate to deltoid-ovate	up to 7 cm wide and about 7 cm long, broadly deltate
ultimate segments of sterile leafs	narrowly ovate, ending in 2–4 blunt tips	ovate to orbicular, ending in little, broad, pointed teeth or rounded
spore length	(40–) 47–59 (–60) µm (see also Dostál 1984)	(64–) 66–76 (–80) µm
number of chromosomes	tetraploid, 2n = 120	octoploid, 2n = c. 240

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DIPHASIASTRUM TRISTACHYUM (PURSH) HOLUB (LYCOPODIACEAE: LYCOPODIOPHYTA) – AN OVERLOOKED EXTINCT BRITISH NATIVE

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Key Words: Clubmoss, *Diphasiastrum alpinum*, *Diphasiastrum* × *issleri*, Hampshire, herbarium

ABSTRACT

During a study of herbarium material previously ascribed to *Diphasiastrum* × *issleri* (Rouy) Holub specimens belonging to the continental European and North American *D. tristachyum* (Pursh) Holub, a taxon not hitherto definitely recorded from the British Isles, were found. While its identity was correctly suggested by Babington when found, it was initially reported as *D. complanatum* before later being placed in *D. alpinum* and subsequently formed the first accepted British record for *D.* × *issleri*. The status of this material is discussed and it is considered to be native to the British Isles. Although not re-found since its discovery in 1866, some suitable habitat remains; given the decline in all lycopods in lowland England it is, however, best considered extinct (EX) and unlikely to re-appear.

INTRODUCTION

The clubmosses of the genus *Diphasiastrum* have long posed taxonomic and nomenclatural conundrums to European botanists, not least through the widespread occurrence of intermediate fertile hybrids, the rank of which has been variously interpreted (cf. Jermy, 1993; Kukkonen, 2000). Given their fertility one might expect a near morphological continuum between taxa and yet there remains little solid evidence for the backcrossing of the fertile intermediate F_1 hybrids, *D.* × *issleri* (Rouy) Holub, *D.* × *zeilleri* (Rouy) Holub and *D.* × *oellgaardii* Stoor, Boudrie, Jérôme, K.Horn & Bennert with their parental taxa *D. alpinum* (L.) Holub, *D. complanatum* (L.) Holub and *D. tristachyum* (Pursh) Holub (Bennert *et al.*, 2011). The cause(s) of this apparent failure is still unclear. However, plants that are difficult to place morphologically are regularly encountered, particularly it would seem in the British Isles, and introgression has been invoked to account for these (Jermy, 1989). Within Britain there has long been recognition of the existence of plants which could not be ascribed with confidence to the widespread montane *D. alpinum*, but determining their true identity and the characters by which they might be diagnosed has been less satisfactorily dealt with. Earlier authors (eg. Druce, 1882) regarded some of these plants as states of *D. complanatum* but it was only comparatively recently that some clarity was brought to the situation by the recognition that these represented hybrids between that taxon and *D. alpinum* (*D.* × *issleri*), the hybrid apparently being present in the absence of the *D. complanatum* parent (Jermy, 1989). The taxonomic treatment currently adopted for

this (see Stace, 2010), as a subspecies under *D. complanatum*, is regrettable, being both misleading and confusing.

Jermy (1989) considered that there may be two ecotypes of this hybrid present, one lowland in England, the other more montane and Scottish, which accorded more closely with typical continental material. He speculated that a Malvern (v.c.37) plant, now sadly lost, was the result of introgression with *D. alpinum*, although Kukkonen (2000) considered it to be atypical *D. alpinum*. Concerns over the identity of some of the lowland examples regarded as this hybrid continue. Difficulties in identification have generally been ascribed to morphological plasticity as a consequence of environmental variables (shade, moisture, juvenility, etc.) and yet recent molecular and cytological studies (Bennert et al., 2011) have revealed that some anomalous morphologically intermediate individuals are triploids, almost certainly derived from the mating of diploid hybrid gametophytes from unreduced gametes (diplospores) with normal haploid gametophytes. It was while attempting to resolve these issues in a British context that a more thorough review of the historical herbarium collections at BM and elsewhere was made and the mis-identification of some specimens became apparent. Most significant was the discovery of unequivocal material of *D. tristachyum*, a plant not hitherto considered to be present in the British Isles.

DIPHASIASTRUM TRISTACHYUM IN BRITAIN

A single specimen of *Diphasiastrum tristachyum* and a photograph of a more fragmentary specimen from the same gathering held at CGE were found amongst specimens filed as *D.* × *issleri* at BM (Figures 1, 2) The material, although sterile, clearly shows the distinctive foliage and habit (see below) of this species.

The *D. tristachyum* material is actually the first and earliest specimen considered by Jermy (1989) to be *Diphasiastrum* × *issleri*. It was initially published as *Lycopodium complanatum* L. in an editorial note in the *Gardener's Chronicle* for 11 August 1886 (Anon, 1866). This reported a communication from John Lloyd claiming "it was found by a woman named Sarah Young, while occupied in cutting Heath for broom-making", at Lower Waggoner's Wells, Bramshott, N. Hants. v.c.12 (SU 85*, 34*). Initially this identification was doubted, Babington (1867) saying " I have not seen it, and doubt its being correctly named" but specimens gathered by Lloyd the following year (Lloyd, 1867a), sent to the editor of the *Gardeners' Chronicle* as *L. alpinum* L., were referred to Babington who "inclines to place it under *L. chamaecyparissus* R. Br., a plant of the Rhine valley" (the differences between European material originally described as L. *chamaecyparissus* and the North American *L. tristachyum* Pursh are slight and all recent authors have treated them in synonymy (eg. Wilce,1965)). The editorial concluded "There are some doubts as to the true name of this *Lycopodium*, arising from the fact that the specimens sent are the barren stems only... It may be *L. alpinum*, but the subterranean rhizome is unlike that species".

Lloyd (1867a) had made particular reference to the buried rhizome, which is indeed a crucial diagnostic character for *tristachyum* and its hybrids, but later doubted the significance of this, having apparently found similar subterranean stems in Welsh *L. alpinum* (Lloyd, 1867b), an observation which may well have helped deliver his find into obscurity! Considerable confusion continued to surround the identity of this plant. Watson (1870) recorded the Bramshott plant as *L. complanatum* but by the time the 2nd edition of his Topographical Botany (Watson, 1883) was published he lists "12", i.e. the record from North Hants. as requiring further investigation, while still accepting

records of *complanatum* from v.c 33, 55, 90 and 102 . Babington also clearly changed his mind as to the identity of the Hants. plants over time. Initially acknowledging but not fully accepting *complanatum* in the 6th (1867) and 7th editions (1874) of his Manual, by the 8th edition (1881) he only lists *alpinum* as British but, shortly afterwards in an Addendum (Babington, 1883), he finally concedes the existence of *complanatum,* listing it as in Hants., Glouc.s., Worcs., Ross and Skye.

The existence of an earlier British specimen of *D. tristachyum* has, however, long been known, although it has generally been dismissed as resulting from an error in mounting and is not mentioned in recent floras (Stace, 2010) or guides (Page, 1997). Druce (1916) was the first to point out the existence of this unequivocal *D. tristachyum* (as *L. chamaecyparissus*) on a herbarium sheet in Herb. C. Bailey (MANCH) – see Figure 3. The shoot is not specifically numbered and thus its affiliation is open to doubt.

IDENTIFICATION

When fertile, *Diphasiastrum tristachyum* is easily recognised by its long pedunculate (4.5 -15cm) fertile shoot usually bearing four or more stalked strobili. The fertile shoots of *D. alpinum* bear 1-2 sessile strobili; those of *D.* × *issleri* also have fewer strobili, which are only shortly (<4cm) pedunculate.

The sterile shoots of *D. tristachyum* are easily distinguished; the 2-3 times bifurcating branches are tightly clustered, fastigiate and all of a similar ultimate length and the narrow glaucous upswept foliage has a very neat appearance. The dorsal leaves are almost as broad as the lateral, not significantly narrower as in *D.* × *issleri* and to a lesser extent *D. alpinum*, and are more similar in shape to the ventral than in either of these. The main axis is subterranean, deeply buried and not just superficial in the litter layer as are those of the other British taxa. *Diphasiastrum tristachyum* is most easily confused with *D.* × *zeilleri*, its hybrid with *D. complanatum*. This differs in its more differentiated lateral leaves, broader (>2 vs. <1.5mm) branchlets and usually greener foliage.

ASSESSING THE STATUS OF *DIPHASIASTRUM TRISTACHYUM* IN THE BRITISH ISLES

Although doubt must surround the true provenance of the material reputedly collected on Ingleborough (v.c. 64), no such doubt attaches to the material from Bramshott. Clubmosses have never been successfully cultivated in this country and would not have been deliberately or unwittingly introduced in this area. The species can therefore either be considered as a chance colonist that failed to persist, or as a rare native that may once have been more widespread.

The native range of *D. tristachyum* is broad, extending through Eastern North America, parts of Asia, the Caucasus and through much of central Europe extending northwards into the Scandinavian mountains (although not as far as its congeners), southwards to the northern Appenines of Italy and now reaching its western limits in Belgium and the Massif central in France. Like many clubmosses it would, however, seem to have been in regression for some time. Habitat destruction, changes in management and land use, even eutrophication and climate change are combining to contribute to this decline, this being particularly marked in the more westerly and lowland areas of this species range. In the mid 19th century the species occurred near Beauvais in the Paris region (Prelli, 2001) and there seems little reason from a phytogeographical perspective why it should not have occurred naturally on the heaths

Figure 1. *Diphasiastrum tristachyum* (Pursh) Holub specimen collected by J. Lloyd at "Lower Wagners (*sic*) Wells, Bramshott, Hants." in 1867 (BM). ©NHM.

of Hampshire, or those in closely adjacent Surrey, all of which supported a wider range of clubmosses (*Huperzia, Lycopodiella, Lycopodium*) in Victorian times (Brewis et al., 1996; Lousley, 1976), although now mostly absent (Rand & Mundell, 2011; Sankey, pers. comm.). We will probably never know whether this Hampshire population was a recent colonist when found, or the vestige of a broader past distribution, although many more continental steppe/breckland specialities were then known nearby in Surrey, including *Holosteum umbellatum* L. and *Veronica triphyllos* L.. It seems best, given this

Figure 2. *Diphasiastrum tristachyum* detail showing leaf shape ©NHM.

uncertainty, to regard this species as "Native or Alien" and give it an Extinct (Ex) category.

COULD *DIPHASIASTRUM TRISTACHYUM* EVER RE-APPEAR HERE OR ELSEWHERE IN THE BRITISH ISLES?

It seems highly unlikely that such a distinctive plant has been overlooked elsewhere, particularly in lowland areas where the occurrence of any member of this genus would have attracted interest and thus close attention.

The small, copiously produced spores of clubmosses should provide a good

Figure 3. Copy of a photograph in BM of a sheet bearing *D. tristachyum* (above centre) interpreted by Druce (1915) as belonging to gathering 1. collected from Ingleborough (v.c. 64) in 1816. Ex herb. Charles Bailey (MANCH).

colonising ability (and may thus explain rather disjunct populations such as this), although with the species in decline and disappearing from the closest continental sites in recent times re-colonisation becomes increasingly unlikely, if not impossible. Most lowland British finds of *Lycopodium sensu lato* in recent decades are, however, more likely to have arisen from disturbance to long buried spore banks, e.g. the recent find of *Lycopodium clavatum* at Long Valley, Eelmoor (v.c.12) (Rand & Mundell, 2011), rather than from remote air-borne sources, the failure of *Huperzia* to re-appear reflecting its predominant recruitment from gemmae and not by sexual means from subterranean gametophytes. Any restoration management thus proposed must take into account what little is known of the species' reproductive biology.

Diphasiastrum tristachyum prefers open *Calluna* and *Vaccinium*-dominated communities, declining as these shrubs become dense and over-mature. It is therefore favoured by management practices like muir–burn, grazing and cutting, which maintain these open heathland conditions. Indeed, the Hampshire plant was discovered by a woman engaged in cutting "Heath" for brooms, an industry which persisted locally in the Grayshott/Hindhead area until the 1930s (Jermy, 1989). The underground rhizome of *D. tristachyum* may confer a little more resistance to fire than demonstrated by other lycopods, the species often flourishing and only sporing well following heathland regeneration by fire (Prelli, 2001); as cover increases with succession fertility declines and the plant becomes vegetative before disappearing into a potentially long-lived spore bank. The cessation of cutting, changes in grazing (and its subsequent cessation) and a reluctance to burn close to a growing centre of population may all have contributed to a decline in extent and quality of suitable habitat in the Bramshott area. As with many lowland heaths, scrub encroachment and woodland succession continue to reduce the available habitat at Bramshott but suitable areas of *Calluna*-dominated heath do remain.

Given its particular biology, if resources and local support can be found then even after nearly 150 years it may well be worth attempting habitat management in an attempt to regenerate this species, safe in the knowledge that any such action would favour heathland communities currently considered of higher conservation priority than the secondary woodlands lost. While it is likely that some degree of soil disturbance may be necessary, recent major accidental fires on nearby sites at Frensham and earlier at Thursley NNR (see Duckett et al., 2008) provide an opportunity to assess potential recovery from spore banks in similar situations in the absence of soil perturbation.

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CONTENTS

Portrait of Clive Jermy
M.H. Rickard 33

COMMEMORATIVE ARTICLE

Clive Jermy - A tribute on the occasion of his 80th birthday, 3rd July 2012
M.H. Rickard 34-36

MAIN ARTICLES

Is *Equisetum ramosissimum* (Equisetaceae: Equisetophyta) native to the British Isles?
F.J. Rumsey & M. Spencer 37-46

***Cryptogramma bithynica* spec. nov. (Pteridaceae, Pteridophyta) – a new fern species from Northwestern Anatolia / Turkey**
S. Jessen, L. Lehmann & W. Bujnoch 47-54

***Diphasiastrum tristachyum* (Pursh) Holub (Lycopodiaceae: Lycopodiophyta) – an overlooked extinct British native**
F.J. Rumsey 55-62

INSTRUCTIONS FOR AUTHORS 64

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